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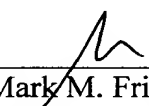
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If any additional fee for claims is required, please charge Account No. 06-2140.

Respectfully submitted,



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[illegible]

Attorney
Docket: 246/68

Commissioner of Patents and Trademarks
Washington, DC 20231
ATTENTION: Board of Patent Appeals and Interferences

This brief is transmitted in triplicate.

This brief contains these items under the following headings and in the order set forth below:

- I. REAL PARTY IN INTEREST
- II. RELATED APPEALS AND INTERFERENCES
- III. STATUS OF CLAIMS
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- V. SUMMARY OF INVENTION
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FIRST PARAGRAPH

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- IX. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

I. REAL PARTY IN INTEREST

The real party in interest in this case is:

M-Systems Flash Disk Pioneers, Ltd.

Central Park 2000

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II. RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences.

III. STATUS OF CLAIMS

Claims 1, 3-6, 10, 13, 14 and 16-30 are being appealed. There are no allowed claims.

IV. STATUS OF AMENDMENTS

In response to the Official Action mailed on January 13, 2004, independent claims 13, 14, 16 and 17 and dependent claims 22 and 23 were amended, and new dependent claims 29 and 30 were added.

V. SUMMARY OF INVENTION

The present invention is a non-volatile memory device for storing both code and data. While the device is programming or erasing its nonvolatile memory, if a host system sends the device a read request, hardware such as one or more logic circuits in the device signals the host to delay executing the request while the device suspends the programming/erasing. Then the hardware suspends the programming/erasing and signals the host to execute the read request. When all read requests have concluded, the hardware resumes the programming/erasing.

VI. ISSUES

The issues presented for review are:

1. Whether claims 29 and 30 contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventors, at the time the application was filed, had possession of the claimed invention;

2. Whether claims 1, 3, 4, 6, 10, 13, 14 and 16-30 are anticipated by See et al., US Patent No. 6,189,070 (henceforth, "See et al. '070"); and

3. Whether claim 5 is unpatentable over See et al. '070 and Keeley et al., US Patent No. 4,491,790 (henceforth, "Keeley et al. '790").

VII. GROUPING OF CLAIMS

For the purpose of the § 112, second paragraph rejections, all claims are grouped separately, and stand and fall on their own merits, except that if a claim falls, then all the claims that depend from that claim also fall. For the purpose of the § 102(b) rejections and the § 103(a) rejections, all claims are grouped separately, and stand and fall on their own merits.

VIII. ARGUMENTS

REJECTIONS UNDER 35 U.S.C. 112, FIRST PARAGRAPH

The Examiner rejected claims 29 and 30 under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner found no support in the specification for the suspending/resuming being effected only by the memory device.

As noted by the Examiner, newly added claim limitations must be supported in the specification through explicit, implicit or inherent disclosure. In the present case, the limitation in question is supported at least implicitly, if not explicitly, in the specification. Specifically, the specification describes how the suspending and resumption of a program/erase operation is managed exclusively by automatic suspend logic 16 and automatic resume logic 27 that are illustrated in Figure 4 as components of the memory device, within the rectangle that encloses the other components (Bus I/F logic 23, Flash array 24 and Flash circuitry 25) of the memory device. Page 8 line 14 through page 9 line 14 describes how the entry to the suspend state is managed exclusively by automatic suspend logic 26. Page 9 line 15 through page 10 line 5 of the specification describes how the resumption of the suspended operation is managed exclusively by automatic resume logic 27.

Consider, first the description of the entry to the suspend state. Entry to the suspend state is contingent on the host attempting to read from the memory device. As stated on page 9 lines 1-13,

Upon detection of the read operation 11 the automatic suspend logic 26 executes a process that enters the device into the suspend state 12...In addition, the logic may mark in a certain place (e.g. I/O port or a dedicated register) that the device has entered the automatic suspend

state 12...In addition, the logic will indicate that the device is on its way to the automatic suspend state 12 using an external signal (Busy signal) 22...The logic is also responsible of verifying that the device has actually entered the automatic suspend state. After the verification phase – the Busy signal will be turned off (to indicate that the device has entered the automatic suspend state 12. (emphasis added)

Note in particular that all the relevant operations (entering the suspend state, marking the entry to the suspend state, turning the Busy signal on and off) are performed only by automatic suspend logic 26.

Now consider the resumption of the suspended operation, as described on page 9 line 16 through page 10 line 5:

The automatic resume logic 27 starts to operate when the device enters the automatic suspend state 12. The target of this logic is to resume the program/erase operation 15 that was interrupted by the automatic suspend logic 26. This logic should monitor the read operations done from the device, for example, by using the same techniques as the automatic suspend logic 26. The logic is responsible to resume the suspended operation. One suggested implementation is to wait for a break in the read operations of the device. When the break is long enough...the logic executes a process which causes the device to resume the program/erase operation 15...The logic contains some mechanism to determine if the break is a real break or just a temporary break...The logic is also responsible to turn off the mark that shows...that the device has entered the automatic suspend state 12. (emphasis added)

Again, all the relevant operations (monitoring for a break in the read operations, distinguishing a real break from a temporary break, unmarking the entry to the suspended state, resuming the program/erase operation) are performed only by automatic resume logic 27.

REJECTIONS UNDER 35 U.S.C. 102

The Examiner rejected claims 1, 3, 4, 6, 10, 13, 14 and 16-30 as being anticipated by See et al. '070.

See et al. '070 teach a memory device **410** whose programming/erasing operations are suspended when processor **402** that accesses device **410** needs to read data from device **410**. (Note that the processor in Figure 2 is labeled “**400**”. This is an error. The reference numeral that is used consistently in the text of See et al. '070 for the processor is “**402**”.) The difference between the present invention and the invention of See et al. '070 lies in which component is responsible for initiating the suspensions of programming/erasing operations. In See et al. '070 processor **402** is responsible for signaling device **410** explicitly to initiate suspension and resumption of the programming/erasing operations as needed. This is in contrast to the present invention, in which hardware in the memory device itself initiates the suspension and resumption of the programming/erasing operations in response to read requests from the host system.

It is clear from See et al. '070 that it is their processor **402**, and not the hardware in signaling device **410** such as circuitry **190**, **192**, **194** and **195**, that takes the initiative in suspending and resuming programming/erasing operations. This aspect of the invention of See et al. '070 is clearest in their claims, for example claim 6:

A system comprising:

a processor;

a nonvolatile writeable memory having an array, the nonvolatile writeable memory having a first mode for allowing the array to be written to, and a second mode for allowing the array to be read from, the nonvolatile writeable memory storing low level code which when executed by the processor cause the processor to perform:

(a) disabling interrupts;

- (b) initiating a non-read operation to the nonvolatile writeable memory while the array is in the first mode and, wherein, the non-read operation is initiated by low-level routines downloaded to a volatile memory from the nonvolatile writeable memory;
- (c) checking for interrupts, and in response to detecting an interrupt performing:
 - (i) suspending the non-read operation;
 - (ii) placing the array in the second mode;
 - (iii) enabling interrupts; and
 - (iv) reading code from the nonvolatile writeable memory. (emphasis added)

and 11:

A computer-readable medium having stored thereon a plurality of instructions which, when executed by a processor, cause the processor to perform:

- (a) disabling interrupts
- (b) initiating a non-read operation to the nonvolatile writeable memory while the array is in a first mode and, wherein, the non-read operation is initiated by low-level routines downloaded to a volatile memory from the nonvolatile writeable memory;
- (c) checking for interrupts, and in response to detecting an interrupt performing the steps of:
 - (i) suspending the non-read operation;
 - (ii) placing the array in a second mode;
 - (iii) enabling interrupts; and
 - (iv) reading code from the nonvolatile writeable memory. (emphasis added)

This aspect of the invention of See et al. '070 also is clear from column 8 lines 65-67:

The program suspend operation is initiated by writing a program suspend command to the command decoder **170**.

and from column 9 lines 5-7:

The erase suspend operation may be initiated by writing an erase suspend command to the command decoder **170**.

Note in particular that from among the commands decoded by command decoder **170**, as listed in column 7 lines 50-52:

...(1) erase, (2) erase suspend, (3) erase resume, (4) program, (5) program suspend, (6) program resume, (7) read, and (8) read status

the “read” command is specifically not used to initiate the suspending and resuming of programming/erasing operations.

This distinction between the present invention and See et al. ‘070 is recited explicitly in independent claims 1, 13, 14, 16, 17 and 24.

The last element recited in claim 1 is:

logic circuit, separate from said host, for enabling automatic suspending and/or automatic resuming of operations in response to a read request from said host (emphasis added)

The first step recited in claim 13 is:

adding at least one logic circuit to the non-volatile memory device

The last step recited in claim 13 is:

commanding the device to suspend and/or resume device operations in response to a read request, by said at least one logic circuit (emphasis added)

The first three steps recited in claim 14 is:

adding at least one logic circuit to the non-volatile memory device

sensing a read request while the device is in program/erase mode/operation, by said at least one logic circuit (emphasis added)

and

in response to said sensing, entering of program and/or erase operations into suspended mode, by said at least one logic circuit (emphasis added)

The last step recited in claim 14 is

exiting of said device from said suspended mode to continue program/erase operation, by said at least one logic circuit (emphasis added)

Claim 16 recites a flash memory device comprising two elements:

a suspend logic circuit for enabling hardware initiated suspending of data processing operations in response to at least one read request received by the memory device from a host (emphasis added)

and

a resume logic circuit for enabling hardware initiated resuming of data processing operations

Claim 17 recites a memory device whose third element is

a hardware mechanism for suspending an activity of said circuitry in response to at least one read request received by the memory device from a host (emphasis added)

The last two steps recited in claim 24 are:

during said operation, requesting a read operation, by the host (emphasis added)

and

in response to said request, suspending said operation, by the memory device (emphasis added)

These arguments were presented in response to the Official Action mailed January 13, 2004. In response to these arguments, the Examiner noted that

The only circuitry explicitly disclosed in the See involving the suspension of programming/erasing is shown in the erase/program suspend circuitry (items 192 & 195 in figure 7) and erase and program suspend and resume latches (178 b, c, e, f).

The Examiner's observation is correct but irrelevant. Erase suspend circuitry **192**, program suspend circuitry **195**, erase latch **176a**, erase suspend latch **176b**, program latch **176d** and program suspend latch **176e** are controlled by command decoder **170** that in turn is controlled by commands received from processor **402**. Among the commands that command decoder **170** receives from processor **402** are (column 7 lines 50-51):

(2) erase suspend, (3) erase resume...(5) program suspend, (6) program resume

So even though the only hardware recited explicitly by See et al. '070 for suspending and resuming programming and erasing operations is inside flash device **410**, it is

clear that processor **402** participates actively in the suspending and resuming programming and erasing operations.

Furthermore, the Examiner did not even address the second aspect of the present invention, as recited in independent claims 1, 13, 14, 16, 17 and 24, that distinguishes the present invention from the teachings of See et al. '070. Flash device **410** of See et al. '070 suspends an erase operation in response to an erase suspend command, not in response to a read command. Flash device **410** of See et al. '070 suspends a programming operation in response to a program suspend command, not in response to a read command. By contrast, the memory device of the present invention suspends erase and programming operations in response to read commands/requests.

Therefore, independent claims 1, 13, 14, 16, 17 and 24 are not anticipated by See et al. '070.

Furthermore, independent claims 1, 13, 14, 16, 17 and 24 are not obvious from See et al. '070. There is neither a hint nor a suggestion in See et al. '070 that flash device **410** should suspend programming operations or erase operations in response to a read command from processor **402**.

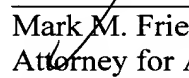
Claims 3, 4, 6, 10, 18-23 and 25-30 are allowable by virtue of depending from independent claims 1, 17 and 24.

REJECTIONS UNDER 35 U.S.C. 103

The Examiner rejected claim 5 as unpatentable over See et al. '070 and Keeley et al. '790.

It is demonstrated above that independent claim 1 is allowable. It follows that claim 5, that depends therefrom, also is allowable.

Respectfully submitted,



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Date: September 19, 2004

IX. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

The text of the claims on appeal is:

1. A system that executes code while processing data operations using a non-volatile memory device, comprising:

host for accessing said memory device;

non volatile array for holding code and data of said system;

non volatile device circuitry for controlling content and activity of said non volatile array; and

logic circuit, separate from said host, for enabling automatic suspending and/or automatic resuming of operations in response to a read request from said host.

3. The system of claim 1, wherein said non-volatile memory device is a flash memory device.

4. The system of claim 1, wherein said logic circuit enables code execution and data storage/processing facilities within a single chip device with a single silicon die.

5. The system of claim 1, wherein said logic circuit enables code execution and data storage/processing facilities within a bank of single memory chips with single silicon dies.

6. The system of claim 1, wherein said logic circuit is embedded into the memory device.

10. The system of claim 1, wherein said logic circuit is operative to monitor status of current operations in said memory device.

13. A method for executing code while processing data on a non-volatile memory device, comprising the steps of:

- i. adding at least one logic circuit to the non-volatile memory device;
- ii. monitoring status of current operations in said memory device, by said at least one logic circuit;
- iii. signaling if the device is available for code execution, by said at least one logic circuit; and
- iv. commanding the device to suspend and/or resume device operations in response to a read request, by said at least one logic circuit.

14. A method for executing code while processing data on a non-volatile memory device, comprising the following steps:

- i. adding at least one logic circuit to the non-volatile memory device;
- ii. sensing a read request while the device is in program/erase mode/operation, by said at least one logic circuit;
- iii. in response to said sensing, entering of program and/or erase operations into suspended mode, by said at least one logic circuit;
- iv. signaling to CPU/Bus to delay executing said read request, by said at least one logic circuit;

- v. turning off signal to allow CPU/Bus to execute said read request, by said at least one logic circuit; and
- vi. exiting of said device from said suspended mode to continue program/erase operation, by said at least one logic circuit.

16. A single flash memory device comprising:

- a suspend logic circuit for enabling hardware initiated suspending of data processing operations in response to at least one read request received by the memory device from a host; and
- a resume logic circuit for enabling hardware initiated resuming of data processing operations.

17. A memory device comprising:

- (a) a non-volatile memory;
- (b) circuitry for reading, programming and erasing said non-volatile memory; and
- (c) a hardware mechanism for suspending an activity of said circuitry in response to at least one read request received by the memory device from a host.

18. The memory device of claim 17, wherein said hardware mechanism also is operative to resume said activity of said circuitry after said circuitry has finished processing said at least one read request.

19. The memory device of claim 17, wherein said activity is erasing said non-volatile memory.

20. The memory device of claim 17, wherein said activity is programming said non-volatile memory.

21. The memory device of claim 17, wherein said hardware mechanism includes at least one logic circuit.

22. The memory device of claim 17, wherein said suspending of said activity includes:

- (A) indicating to said host that issued said at least one read request that execution of said at least one read request should be delayed; and
- (B) subsequently, indicating to said host that the memory device is available for reading.

23. The memory device of claim 17, wherein said hardware mechanism is further operative to monitor said processing of said at least one read request to determine when said circuitry has finished processing said at least one read request.

24. A method for managing a memory device that includes a non-volatile memory and that is accessed by a host, comprising the steps of:

- (a) commencing an operation selected from the group consisting of erasing the non-volatile memory and programming the non-volatile memory, by the memory device;

- (b) during said operation, requesting a read operation, by the host; and
- (c) in response to said request, suspending said operation, by the memory device.

25. The method of claim 24, further comprising the step of:

- (d) in response to said request, signaling to the host to delay execution of said request, by the memory device.

26. The method of claim 25, further comprising the step of:

- (e) in response to said signal, delaying execution of said request, by the host.

27. The method of claim 26, further comprising the step of:

- (f) signaling the host to resume execution of said request, by the memory device.

28. The method of claim 27, further comprising the steps of:

- (g) subsequent to said suspending, monitoring a conclusion of read requests from the host, by the memory device; and
- (h) upon detecting said conclusion, resuming said operation, by the memory device.

29. The method of claim 24, wherein said suspending is effected only by the memory device.

30. The method of claim 28, wherein said resuming is effected only by the memory device.